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ABSTRACT

Students' difficulties in assimilating new concepts can be a barrier to learning and may be exacerbated if the concepts are introduced in terms of detailed verbal definitions. Cognitive psychology suggests that a better approach to teaching new concepts may be to use prototypical examples of the concept as building-blocks from which verbal definitions can be understood and remembered. The steps in such a teaching technique include introducing the phenomenon, naming the term, describing one or two prototypical examples, providing the formal definition, matching the characteristics of the prototypes to each part of the definition, and providing additional examples which do and do not fit into the definition. For example, in explaining the concept of a caste system, first, the concept would be introduced; then India's classical caste system, which divided the society into brahmins, warriors, merchants, untouchables, etc., could provide the prototype of a caste system; and next the technical definition of caste system could be introduced and linked to the prototype. In this way the student can reconstruct the elements of the definition of the caste system, even if the verbal definition itself was not recalled. The technique is most effective if prototypes are vivid and concrete, if it is clear that prototypes are not the only examples, and if students are helped to focus on the relevant characteristics of the prototypes. (HB)

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HOW TO HELP YOUR STUDENTS RECALL NEW CONCEPTS BETTER

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JC 820 407

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HOW TO HELP YOUR STUDENTS RECALL NEW CONCEPTS BETTER

When students cannot learn the meaning of new concepts, it slows down the rest of their learning. Yet students seem to learn and forget concepts by the hundreds. Teachers try persistently to teach concepts well, to give relevant examples, to restate definitions, to use concepts in the correct context, and to give drill-and-practice exercises. Yet many students fumble far too often in their handling of the vital task of remembering new technical terms.

I have recently been reading in the field of cognitive psychology. There are some interesting findings which suggest a method for teaching concepts that will improve students' ability to recall them. I want to warn, however, that although the findings are real enough, these applications to teaching are purely my own inferences. I could be wrong in thinking this simple method will help. Obviously, I do think it will work, but some of you readers will have to try it out and tell me whether it works.

Prototype Examples of Concepts

First, I need to explain some research findings about natural categories and prototypes in order to set the stage for the teaching method.

A scholar named Elizabeth Rosch has been studying natural categories like birds, furniture, and games. They are classes of things that occur in the real world. Consider birds. There are robins, wrens, and sparrows. But there are also vultures, ostriches, and emus. All birds. Suppose someone asked you, "What are the most typical birds?" Most people would answer, "Robins, wrens, and sparrows." The fact that most people would answer that way reveals that we have shared ideas as to what instances of the concept of birds are the most normal instances, the most typical instances--or, in a word, prototypes.

You can do the same thing with furniture. I'll list a series of examples of furniture and start with items that are prototypes and end with items that are nonprototypical of furniture: Chairs, beds, tables, lamps, stools, end tables, hat racks, pianos. It must be stressed that all of the examples are truly members of the category. A hat rack is an instance of the category furniture even though it's not a prototype. Yet Rosch and other cognitive psychologists appear to have demonstrated that people actually think in terms of prototypes when they think of concepts. Even though people think of certain examples as prototypes of concepts, it does not appear to confuse them about nonprototypical instances of concepts. You can check this yourself. Think about the concept of mammals. Although we usually think of cows, dogs, and cats as prototypes of mammals, it doesn't confuse us into forgetting that sea-going animals like whales and dolphins are mammals, too. We just think of cows as more typical of the category than whales, but we know that whales are truly members of the category.

There are some concepts which need more than one prototype. The concept of games is extremely broad, covering soccer, tennis, football, chess, bridge, poker, solitaire, quiz shows, and so on. It is extremely difficult to list one set of features covering all the instances of the concept. Hence, perhaps two or three prototypes exist in people's heads.

Here is the important idea: When people hear or read or think of a concept, they appear to refer to a prototype of the concept. When you read the word prototype just now, perhaps you just flashed back in your mind to birds and robins or to furniture and chairs or to mammals and cows. One of those examples became to you a prototype of prototypes.

If people do mentally think of a concept in terms of a concrete prototypical example, one which that is often a visual image, then they are not thinking of a wordy verbal definition of it. People don't, for example, read the word "mammal" and quickly think "a warm-blooded animal that gives birth to living young." They don't hear you say "birds" and then mentally flash to "birds are feathered animals that lay eggs." (Biologists, I apologize.) People don't usually think from words to their abstract definitions; instead they hear a word and link it to an image or to some realistic example of this concept. This is the important point.

Yet we often don't use prototypes to help our students learn. Instead we often teach students to learn strings of words as a definition of a concept and stop there. This is probably ineffective.

How to Use Prototypes to Teach New Concepts to Students

Since people naturally appear to think of concepts in terms of concrete examples that are prototypes of the concepts, why don't we take advantage of their tendency? We can teach students to think of a prototype every time they learn a new concept.

Here is how it might proceed.

1. Introduce the phenomenon by giving examples or by setting the stage some other way.
2. Name the term.
3. Describe one or two prototypical examples.
4. Give the formal definition.
5. Show the students how the characteristics of the prototypical examples match each part of the definition.
6. Name some other examples that also fit into the category. Be sure to cover the broad range of instances that fit the category.

7. Clear up confusions by pointing out confusing examples that look superficially like instances of the category, but really do not fit the category.

Instructors should also give the students two basic instructions.

First, they should tell the students to take notes on the concept, the prototype and the verbal definition. (Of course, they can take other notes on other examples, the way the definition fits examples, other examples, and confusing cases that are not part of the category. But the triad of term-prototype-definition is primary.)

Second, instruct the students to deliberately search their memory for the meaning to the concept by thinking of the prototype first and then the definition. On a test they should ask themselves, "What is a typical example of an X?" That question should trigger their memory.

After that, the students can broaden out their thinking by thinking of other examples.

Here is how one might introduce the concept of a caste system in a society. One would start perhaps by describing social classes and inequality in societies. Then name the term caste system. One might describe India's castes--the brahmins, warriors, merchants, untouchables, etc. One would indicate that India's system is a prototype. Then one reels off the technical definition: "A caste system is the organization of a society into social strata, marked by different degrees of ritual purity or pollution, socially defined as unchanging in prestige ranking, into which the individual is born and from which he or she may not rise (although it is possible to be cast out for some violation of caste rules)." (William J. Goode, Principles of Sociology. New York: McGraw-Hill, 1977, p. 526.) Next, one would go over

the features of this definition and show how they fit India. One would then give examples of caste systems in other societies, small and large; one might extend the example to racism in America. Finally, one might give some examples of socially rigid societies like classical China, which nevertheless did not have true castes.

One would tell the students to take notes on the term "caste system," the details on India's system, and the exact formal definition.

If a student forgot the definition of a caste system, he or she might be able to reconstruct it if the prototype of India's system had been firmly studied. If a teacher has shown step by step how each part of the definition is exemplified in the prototypical examples, all the student needs to do is to think over the example. If the teacher has pointed out what features of the prototype are defining features and which features are irrelevant to the definition, the student can often easily assemble the definition.

Many students are not aware that they search their memories in ineffective ways. Teachers will have to point out to their students that they often hear a word and forget to ask themselves what the examples of the concept were. Teachers might have to make a demonstration that students often hear a technical term and immediately try to state the string of words in the definition. However, once students notice with joy how much their memories improve when they think from the concepts to the prototypes and then to the definitions, they will be convinced. For example, they will hear the words "social norms," imagine a line of cars stopped at a red traffic signal, and then recall the definition, "Social norms are shared ideas among group members as to what people should do, ought to do, are expected to do in a certain situation."

What Makes Good Prototypes?

All the traits that make for vivid and concrete writing and storytelling make for good prototypical examples.

--Concrete examples that the teacher describes clearly

--Pictures, diagrams, and charts that have a clear message

--Interesting stories about real people and events

--Real experiences that students can have with concepts and principles in labs and demonstrations and practice sessions

Some Mistakes to Avoid

1. Don't name a concept that is new and then give another new and difficult name as a prototype. For example, a biology instructor was naming various phyla and giving examples of them. She named the phytoplankton and said that diatoms were examples of them. However, many students did not know what diatoms were and missed the point. She should have shown pictures and described the characteristics of diatoms. The point of giving prototypes is to show or describe something in a vividly memorable way.
2. If the concept being taught has many possible examples, don't leave the students thinking that the prototype examples are the only examples. A teacher must make it clear that a prototype is merely a very typical example and that there are other examples. A teacher must show that non-typical examples, more exotic than the prototype, still fit the abstract verbal definition. After all, marsupials and monotremes are mammals, too.
3. Don't leave the students thinking that irrelevant traits of the prototype examples are somehow necessary important traits. I can remember a biology class where the instructor tested our recognition of red alder leaves with the biggest specimen we'd ever seen. He had always shown us

small to medium leaves. Size was irrelevant. We formed the false conclusion that their size was a defining characteristic, and we flubbed the testing example.

Conclusion

This method of teaching concepts takes advantage of people's tendency to think in pictures more often than in words. It is also helpful at a community college where many of our students have limited vocabularies and are slow at handling new words and concepts. Our students still can learn if we give them a pattern to their learning. And the pattern is this: Think from the name to the prototype to the definition. And from there one can think to the larger world of the other examples of the concept and subtle dimensions of its meaning.

So when you teach new concepts, prepare some gorgeous typical examples. Tell your students to deliberately use them as a mental tool to remember the meaning of the new concept.

For brief discussions of prototypes see the following references:

John R. Anderson, Cognitive Psychology and Its Implications. San Francisco: W. H. Freeman and Co., 1980. Chapter 5, "Schemas and Prototypes."

Roy Lachman et al., Cognitive Psychology and Information Processing: An Introduction. Hillsdale, N. J.: Lawrence Erlbaum Associates, 1979, pp. 320-321.

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